

Notes on the Biology of *Pissodes fasciatus* LeConte and its Insect Associates

(Coleoptera: Curculionidae)

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The genus *Pissodes* includes about 11 species, which are sharply divided into two ecological groups: species that breed in growing terminals and laterals of conifers, and species that breed in boles and stumps of moribund and recently killed conifers (Smith and Sugden, 1969). *Pissodes fasciatus* LeConte belongs to the latter group, breeding in stumps and boles of Douglas-fir, *Pseudotsuga menziesii* (Mirbel) Franco. *Pissodes* is a notably homogeneous group; size and elytral scale patterns are the only external morphological characters that can easily be used to separate *P. fasciatus* from sympatric species such as *P. strobi* (Peck) (= *sitchensis* Hopk.) that destroy terminals of healthy conifers. In its habitat preferences, however, *P. fasciatus* is closely related to Douglas-fir bark beetles, such as *Dendroctonus pseudotsugae* Hopkins and *Hylastes nigrinus* (Mannerheim). The insect associates of *P. fasciatus* reflect both its taxonomic and ecological relationships, some being regularly associated with various species of *Pissodes*, others being regularly associated with bark beetles.

Studies of *Pissodes fasciatus* were undertaken as part of a comprehensive study of the insect fauna of dead Douglas-fir. Most observations on *P. fasciatus* were made in the Cedar River Watershed, Cedar Falls, King Co., Washington. During 1971 trees were cut at monthly intervals and the invading insects were observed and collected. During 1971 through 1976 numerous naturally occurring dead Douglas-fir were examined. Sections of Douglas-fir occupied by *Pissodes* were brought into the laboratory for examination. Insect associates were removed and placed, usually accompanied by a small piece of bark, on a pad of paper toweling in a 100 x 15 mm. Optilux Petri dish. The Petri dishes were kept at room temperature and the paper toweling was moistened with a few drops of water every other day.

Biology

Pissodes fasciatus is very abundant in second growth stands in western Washington, where it breeds in shaded boles and stumps of dead and dying Douglas-fir. Cut or windthrown trees supply most of

the breeding material, but the root crowns of pole-sized suppressed trees are occasionally attacked. *Pissodes fasciatus* also breeds in the stumps of Christmas trees in open plantations, but only when the stumps are heavily shaded by brush. Larvae occur in bark that is about .5 cm to over 2 cm thick.

This habitat of *P. fasciatus* in thicker bark of shaded Douglas-fir seems very similar to the habitats of the bark beetles *Dendroctonus pseudotsugae* and *Hylastes nigrinus*. *Pissodes fasciatus*, however, prefers a much more humid subcortical environment than that preferred by *D. pseudotsugae*, and it is usually found in bark actually in contact with wet ground, in the moist bark around the root collar or on the underside of the bole of trees lying in very dense shade. It is not unusual to find *D. pseudotsugae* occupying the upper side of the bole of a fallen tree and *P. fasciatus* occupying the lower side. *Hylastes nigrinus* occasionally occurs in root crowns with *P. fasciatus*, but more frequently breeds in buried roots.

The life cycle of *P. fasciatus* in western Washington is partially known. Like adult *Pissodes approximatus* Hopkins (Finnegan, 1958) many adult *P. fasciatus* apparently overwinter and may be seen mating and ovipositing on freshly fallen or cut trees in early spring when the air temperature first reaches 18-20°C. Oviposition continues into August, and there are many overwintering larvae; it is not known when these overwintering larvae emerge. Recently emerged adults probably feed on phloem of healthy trees as do other bole-inhabiting species of *Pissodes* (Finnegan, 1958), but it is not known where this feeding occurs, and there are no reports of damage caused by adult *P. fasciatus*.

Oviposition has been observed on several occasions. The female excavates a niche in the outer bark with her rostrum and deposits one to six oval yellowish eggs about 1.2 mm long. The puncture is partially filled in with particles that could be either frass or bits of wood.

The larvae make galleries in the inner bark parallel to the grain of the wood. The galleries usually do not engrave the surface of the sapwood. The pupal chamber is lined with bits of wood or bark and may be in the bark or in the surface of the sapwood. If the bark is thin, the pupal cell is likely to be in the surface of the sapwood.

Insect Associates

In western Washington *P. fasciatus* is attacked by four parasitoid wasps. Larvae found under particularly thin bark may be attacked by a braconid, *Bracon pini* (Meusebeck) that has an ovipositor about 1.2-1.6 mm long. *Bracon pini* is an external parasitoid and there are usually two or three parasites produced from each host. Larvae under thicker bark are vulnerable to another braconid, *Coeloides brunneri* Viereck, that has an ovipositor 4.5-7 mm long. *Coeloides brunneri* is a solitary

external parasitoid. The population of *C. brunneri* remains at a relatively high level because of the abundance of its primary host, the bark beetle *Dendroctonus pseudotsugae*. *Coeloides brunneri* is often the most important parasitoid of *P. fasciatus* in thin bark. Under slightly thicker bark *P. fasciatus* larvae remain available to another solitary external parasitoid, *Dolichomitus terebrans nubilipennis* (Viereck), an ichneumonid with an ovipositor 7.8-10.5 mm long. Finally, the braconid *Allodorus crassigaster* (Provancher) avoids the problem of bark thickness by ovipositing in the eggs of its host. The solitary parasitoid larva does not kill its host until the latter is almost mature. Female *A. crassigaster* may be observed waiting a few millimeters from a *P. fasciatus* that is unconcernedly ovipositing; before the weevil has left the scene its eggs are already being attacked by the braconid.

Four additional insects are associated with *P. fasciatus* in western Washington. The lonchaeid, *Lonchaea furnissi* McAlpine, is apparently a scavenger, feeding on dead larvae and pupae of *P. fasciatus*. The dolichopodids, *Medetera vidua* Wheeler and *Medetera arctica* VanDuzee, are predators that attack larvae and probably pupae. Adults of a 2.7 mm staphylinid, *Atheta* sp., have been found in *P. fasciatus* galleries; the role of this species is unknown.

None of these eight species of associates is confined to the galleries of *P. fasciatus*. *Coeloides brunneri*, *Lonchaea furnissi*, *Medetera arctica*, *M. vidua*, and *Atheta* sp. are all common associates of bark beetles. All these species are found in the galleries of *Dendroctonus pseudotsugae* with the exception of *M. vidua*, which occurs in more humid habitats such as the galleries of *Hylastes nigrinus* in roots (Zethner-Møller and Rudinsky, 1967) or the galleries of *Ips concinnus* in heavily shaded Sitka spruce. *Bracon pini*, *Dolichomitus terebrans*, and *Allodorus crassigaster* are parasitoids of several species of *Pissodes*, including species that breed in leaders and laterals (Stevenson, 1963; Taylor, 1929; Townes and Townes, 1960). Considering the paramount importance of habitat in the selection of hosts by ichneumonids (Townes, 1960) and braconids (Matthews, 1974), it is probable that the species of *Bracon*, *Dolichomitus* and *Allodorus* that attack *Pissodes* in the bole and roots of dead trees are in reality sibling species of those that attack *Pissodes* in terminals and leaders of healthy trees.

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Literature Cited

- Finnegan, R.J.** 1958. The pine weevil, *Pissodes approximatus* Hopk., in southern Ontario. Can. Entomol. 90:348-354.
- Matthews, R.W.** 1974. Biology of Braconidae. Ann. Rev. Entomol. 19:15-32.
- Smith, S.G., and B.A. Sugden.** 1969. Host trees and breeding sites of native North American *Pissodes* bark weevils, with a note on synonymy. Ann. Entomol. Soc. Amer. 62:146-148.
- Stevenson, R.E.** 1963. Insects associated with the Engelmann spruce weevil, *Pissodes engelmanni* Hopkins. Can. Dept. For. Bi-Mon. Res. Notes 19:2-3.
- Taylor, R.L.** 1929. The biology of the white pine weevil *Pissodes strobi* (Peck), and a study of its insect parasites from an economic viewpoint. Entomol. Amer. N.S. 10:1-83.
- Townes, H.** 1960. Host selection patterns in some Nearctic ichneumonids. 11th Int. Congr. Entomol., Vienna 2:738-741.
- Townes, H., and M. Townes.** 1960. Ichneumon-flies of America north of Mexico: 2. Subfamilies Ephialtinae, Xoridinae, Acaenitinae. Bull. U.S. Nat. Mus. 216:1-676.
- Zethner-Møller, O., and J.A. Rudinsky.** 1967. On the biology of *Hylastes nigrinus* (Coleoptera: Scolytidae) in western Oregon. Can. Entomol. 99:897-910.

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